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*International*
*Journal*
*Of Modern Engineering Research (IJMER)*

# Outpatient Flow Management by Reducing Waiting Time between Stages of the Care

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***ABSTRACT:*** *This paper examines working of outdoor patient department in a general hospital. There are several out-patient departments and hundreds of patients visite the hospital daily for treatment. The main objective is to minimize the average waiting time of the patients. The current performance is determined and newer ways are identified to improve the performance of the hospital. Various alternatives are found and evaluated by simulating each of them. The objective of minimizing waiting time of the patients is achieved by altering the process by keeping the resource (staffs and doctors) constant which is against the conventional and commonly held view of shortage of staffs. The approach used is DMAIC type, Data analytics for analysis and discrete event simulation for evaluation of suggestion. The creation of the model is based on data collection and concepts of queuing theory. The improvement is achieved by keeping the existing resource as a constant parameter.*
***Keywords***: *Out Patient Department (OPD), discrete event simulator, Waiting Time, Patient flow.*

## I. INTRODUCTION

The hospital in consideration is located in the state of Tamilnadu, India. It has a capacity of 500 beds in inpatient wards. It caters to approximately 1000 patients on average on any given day in the outdoor patients departments (OPDs).OPD provides services to those patients who are not required to be admitted to hospital. They are given medicines and are required to visit again as requested or required by the doctor. Staff shortage in the hospital is a major concern as for the employees in the hospital [1]. Given the increase in patient traffic, the only feasible option is to look for ways and suggest means by which the performance of the system could be improved [2].

In this case, I focus on OPD, as it is the section where the hospital experiences heavy load.
Since the hospital is a dedicated one for the employees of the organization, delay in the system may directly affect the production . For example, any OPD patient has to spend minimum of about 3 hours in the current system to get treated. So one has to spend at least a day for visiting the opd, in the worst case scenario (rescheduling or revisit without consultation) couple of days.

Opinion of Employees is that The time for consultation fluctuates every day which makes it difficult to work, There is shortage of doctors. Random crowd accumulation. Lack of no. of support staff.

## II. PROBLEM DESCRIPTION

The issue of longer patient waiting time in the outpatient department (OPD) of this hospital leads to longer waiting times to get treated and leads to congestion at OPD.

This problem is managed by
(a) Extended consulting hours.
(b) Postponing appointment at the last minutes.
(c) Re-visit of appointment less patients some other day.
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### A. Objective

The main objective is to minimize the waiting time of the patients in the opd.
Steps to achieve objective,

- To map the entire process flow from patient entry till exit.
- Identify areas of delay.
- Identify causes of delay.
- Propose recommendations and reflect them in simulation.
- Find the effectiveness of the recommendation.

### B. Scope

The project have in its scope the identification and measurement of bottlenecks in the process and to suggestion changes that has to be made and impact is assessed. The project do not have in its scope the above mentioned for Inpatients.

### C. Assumptions

- The time for consultation with doctor is constant.
- The time for medical procedure like X ray, blood test etc is constant and standard.
- The time for getting medicine from pharmacy is constant.

### D. Methodology

The approach used is DMAIC type, Data analytics for analysis and discrete event simulation for evaluation of suggestion.

## III. PATIENT FLOW

In healthcare, flow is the movement of patients, between departments, staff groups as part of a patient's care pathway[3]. Patient flow means movement of patients through multiple stages of care. Patient flow management represents ability of healthcare system to serve patients quickly and efficiently as they move through stages of care[4].

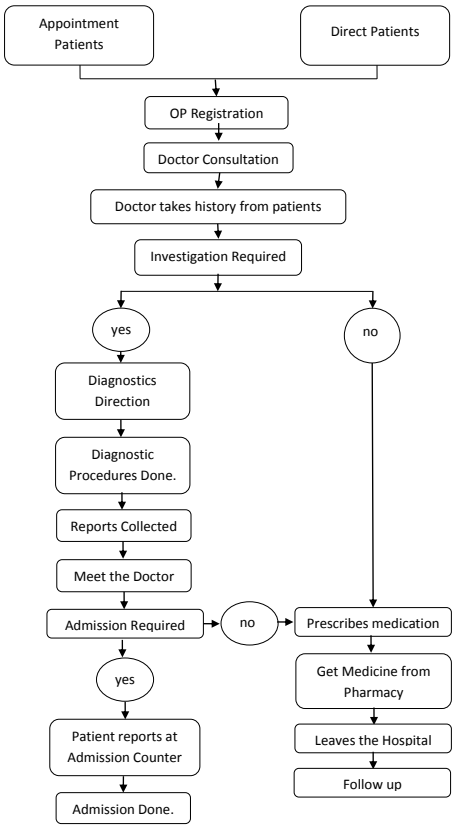


Figure 1 Patient Flow Process Chart

Patients without appointments (walk-in and transfer) also arrive at the OPD registration desk; However, if all doctor's time slots are filled, they will be scheduled for visits on later days.

Table 1 Scenario Timing

| S no. | Stages | Time |
|---|---|---|
| 1 | Registration counter open | 7.30 am |
| 2 | Doctor's arrival | 9.00 am (≥ 30 mins) |
| 3 | Break time start | 11.00 am |
| 4 | Break time end | 11.30 am (≥ 15 mins) |
| 5 | Morning session end | 12.30 pm |
| 6 | Registration start | 1.30 pm |
| 7 | Registration end | 3.00 pm |
| 8 | Doctor arrival | 2.30 pm |
| 9 | Session end | 4.30 pm (≥ 60 mins) |

The deviation in the system is an obvious issues which is due to several reasons for instance doctors arrival is delayed due to his prior visit to inpatient ward

Table 2 Data summary

| S no. | Stages | Avg. time | Max. time | Min time | SD |
|---|---|---|---|---|---|
| 1 | Op reg. time | 1.7785 | 4.03 | 1.08 | 1.55 |
| 2 | Reg. waiting time | 13.1 | 41 | 2.2 | 20 |
| 3 | Waiting time | 79.8 | 133 | 31 | 51.01 |
| 4 | Doctor consultation time | 76 | 13 | 5 | 4.08 |
| 5 | Pharmacy waiting time | 4.9 | 8 | 2 | 3 |
| 6 | Pharmacy operation time | 10.42 | 18 | 5 | 6.53 |
| 7 | Total time | 117.6 | 217.03 | 46.3 | SD |

A random patient would spend about 46.3 to 217.03 minutes in the system.

**A. Patient's Arrival:**

There is a lot of variation in the number of patients arriving each hour. Since registration starts at 7.30 AM, patients start coming from 7.25 AM. There is a constant and steady arrival of patients up to 9.30 AM. A large number of patients come for medical OPDs. This results in long queues during peak times at counters.

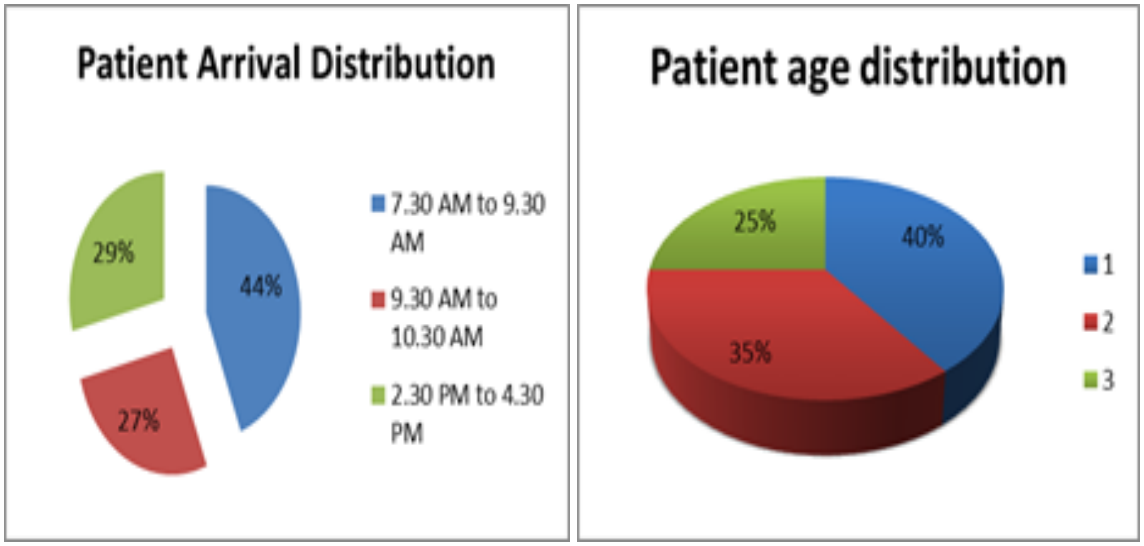


Figure 2 Patient distribution

## IV. DATA AND ANALYSIS

The data is collected by self-observation, pre-existing records and by preparing a format in which time slots are given to each activity i.e., waiting time for op registration, waiting time for doctor consultation, testing and dispatch of reports and medicine. Data is analysed by plotting graphs and histogram.

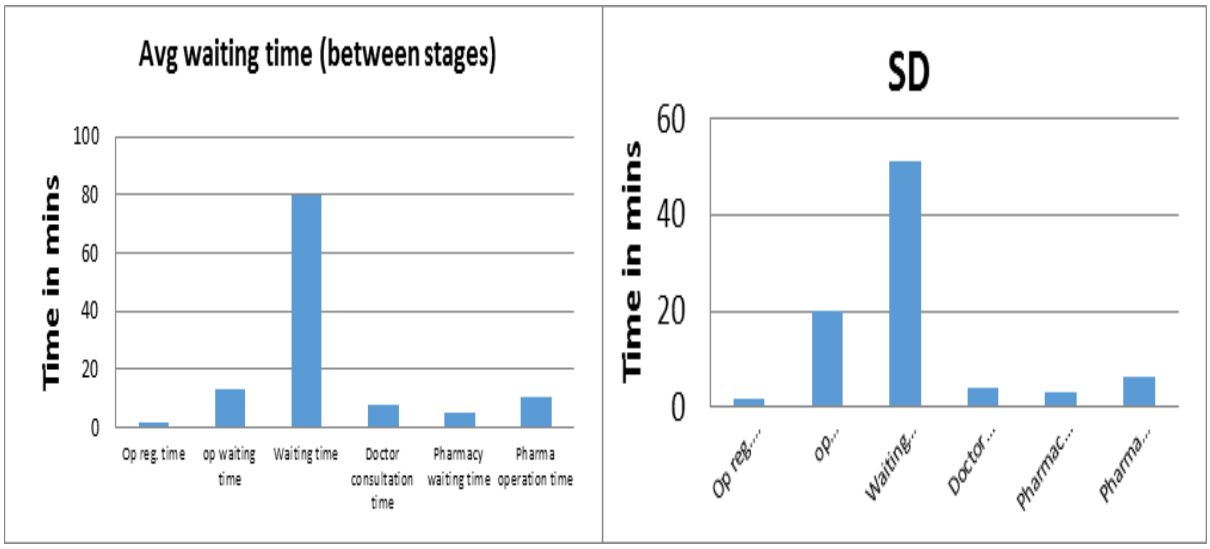


Figure 3 Patients time taken between stages and STD Deviation

The average time taken by the patients is maximum for registration and waiting time before doctor consultation which will be focused mainly and efforts will be made to minimize them.Not only the time is maximum, standard deviation is also quit high which is a major issue which has to be taken care of as soon as possible.

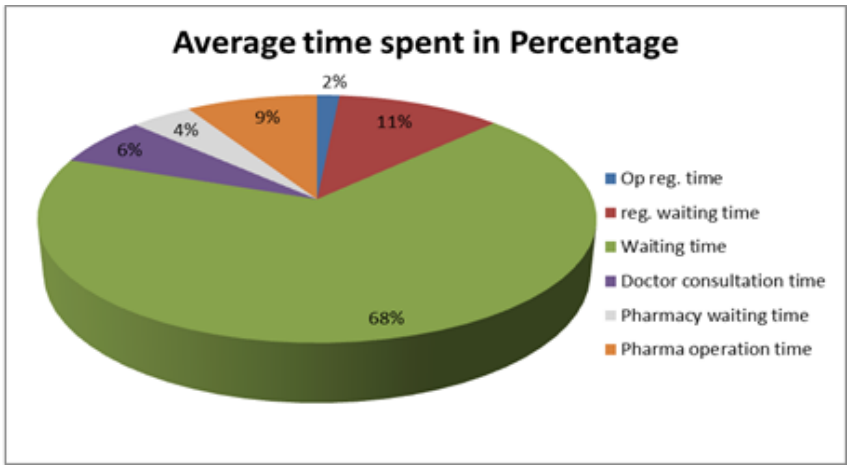


Figure 4 Average time spent on each stage

About 80% of the time is spent waiting or blocked, which is not an ideal sign for an effective system.

### A. Identified bottlenecks:

1. Waiting time before registration.
2. Waiting time before consultation.

### B. Reasons identified:

1. Early start of registration. (before 2.5 hrs).
2. Late arrival of the doctors. (≥ 30mins).
3. Improper break timings and practices. (≥45 mins).
4. Dedicated registration counters.

### C. Method of approach:

Series of changes to be incorporated into the system to make it more effective by reducing the waiting time are proposed below:

- Late start of the registration. (before an hour) (1)
- On time arrival of the doctors by reliving them of inpatient duty. (2)
- Reducing break time (on the spot break). (1)(2)
- Flexible registration counters (except for emergency counter) (1)

## V. NEW PROCESS MODELS AND SIMULATED SOLUTIONS

A discrete event simulation software is used for evaluating the above strategic situations.
Various alternatives that have been simulated are as follows:
1. Existing Scenario (ES):
2. Increased resource.
3. Flexible Registration(FR):
4. Late Flexible Registration with Reduced Break and On Time Arrival of doctor (LFRRBTOT).

Examination by doctor is considered to be a value-add-activity. Registration is considered to be non-value-add as it is required by the hospital and is not a need of the patients. None of the scenarios modified any value-add or non-value-add activity.[5]
Parameters to be measured are as follows:
1.Time spent;
2. Resource utilization;

**a. Existing scenario (Es):**

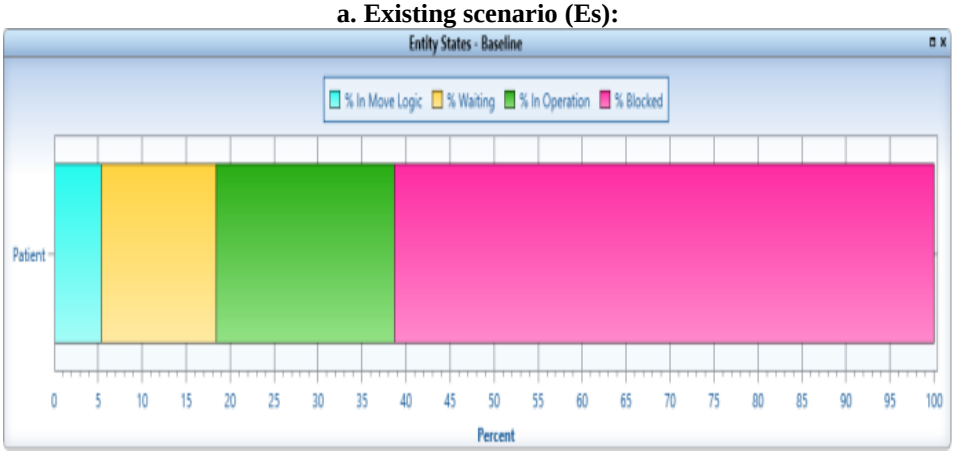


Figure 5 Existing system Time spent

**b. Increased resource (IR):**

Increasing the number of resource obviously decreases the waiting time due to increased service level but the option is not effective in this case because the resource utilization rate is drastically lowered.

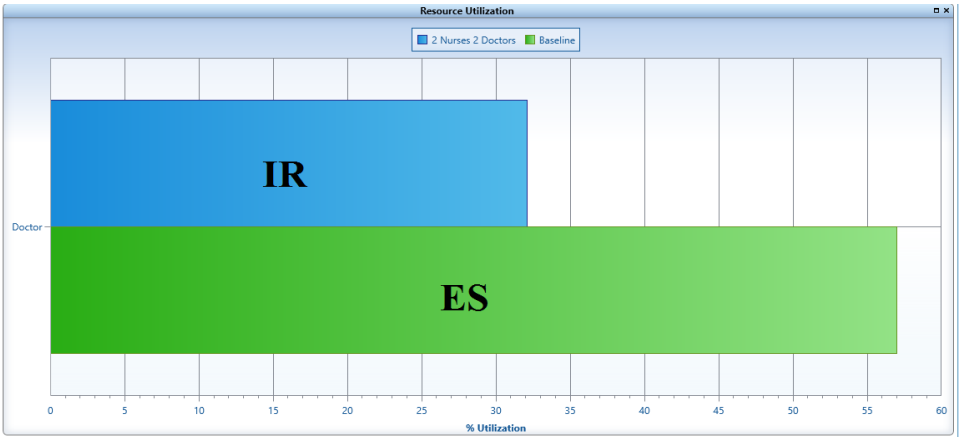


Figure 6 Resource Utilization under increased resource

**c. Flexible registration(fr):**
Flexible registration strategy reduces registration waiting time by allowing jockeying.

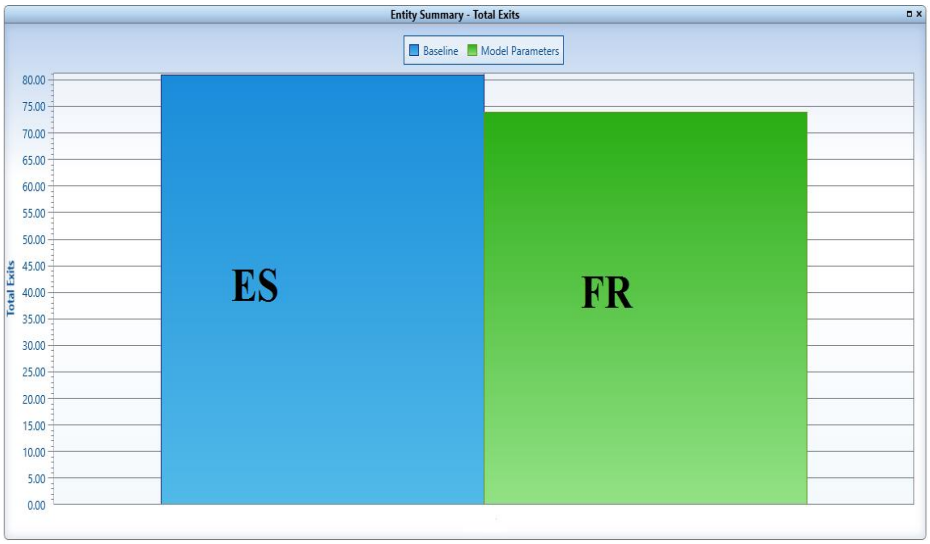


Figure 7 Existing system and FR Total average time

**d. LFRRBTOT scenario:**
Late Flexible Registration with Reduce Break and On Time Arrival of doctor.

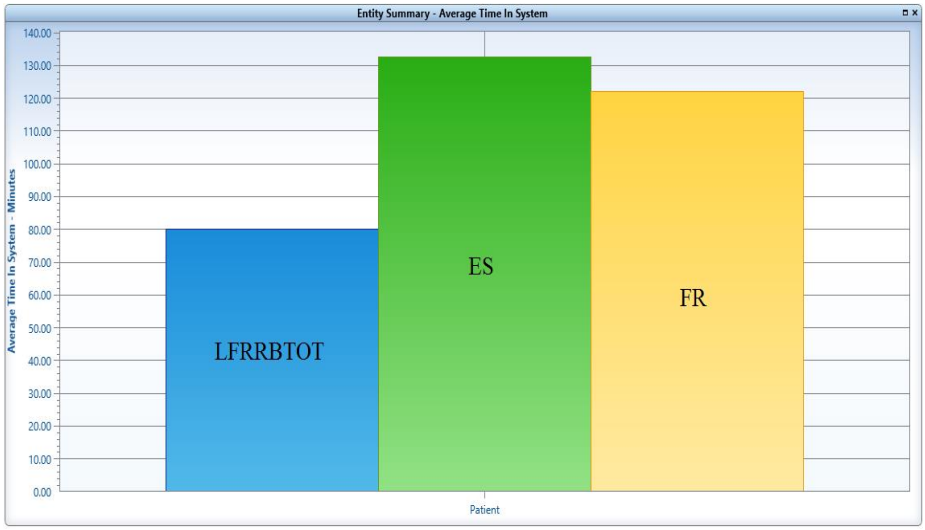


Figure 8 LFRRBTOT vs ES vs FR

The results shows that the LFRRBTOT scenario yields great results than the existing system with same number of resources so this system is proposed.

Table 3 Aggregate time taken in various scenarios

| | ES mins | FR mins | LFRBTOT |
|---|---|---|---|
| Non-Value-Add Time | 1.78 | 1.73 | 1.77 |
| Value-Add Time | 13.2 | 13 | 13.6 |
| Waiting Time | 133.4 | 123.6 | 80.13 |
| Total Time: Overall Average | 117.6 | 106.2 | 67.6 |
| Total Time: Maximum Average | 217.03 | 201.3 | 142.8 |
| Total Time: Minimum Average | 46.3 | 40.1 | 28.4 |

## VI. VALIDATION

The simulated data was validated by collecting actual observation and following checks were made.

1. The number of patients arriving should be same as the real scenario.
2. The number of doctors available should match the availability in the hospital.
3. The time taken between each station should match simulated results.

Table 4 Validation Summary

| S no. | | Actual Observation | Result (ES) |
|---|---|---|---|
| 1 | Op reg. time | 1.7 | 2.1 |
| 2 | reg. waiting time | 13.1 | 12.11 |
| 3 | Waiting time | 79.8 | 81.3 |
| 4 | Doctor consultation time | 7.6 | 10.57 |
| 5 | Pharmacy waiting time | 4.9 | 5.1 |
| 6 | Pharmacy operation time | 10.42 | 10 |
| 7 | Total time | 117.6 | 121.18 |

The validation of that study shows that the simulated and actual results are similar with minimum deviation which is acceptable.

## VII. IMPLICATIONS

The above study implies the following:

**A. Identify Bottlenecks and Remove them:**

The bottle necks are found to be improper break timing, late arrival of doctor which are dealt with. It is important to note that whenever bottlenecks are removed from one location, newer bottlenecks are created at other places. Therefore, it becomes a continuous process rather than a one-time process.

**B. Resource Shortage is not the actual problem:**

The problem lies in the resource utilization than resource utilization. If the number of doctors are increased their utilization decreased to very low so, the process is modified to increase the utilization and not increase the **resource.**

**C. Avoiding Special Purpose Counters:**

Making the registration centers flexible from a dedicated one enables jockeying and lead to reduced waiting time.

## VIII. CONCLUSIONS

In this paper, we measured the flow of patients in OPD of a hospital and identified the bottlenecks in the system. Alternatives are suggested with a constrain of constant resource to increase the effectiveness of the system by reducing the waiting time of the patients. we also showed that waiting time is decreased by changing the manner the activities are performed rather than as against the commonly held view that there is a shortage of staff in the hospital.

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